CLAIMS

What is claimed is:

1. A method for forming a pole tip, comprising:

forming a pole tip layer of magnetic material;

adding a layer of polyimide precursor material above the pole tip layer;

curing the polyimide precursor material;

adding an oxygen etch resistant resist layer above the layer of polyimide precursor material;

patterning the etch resistant layer;

exposing the polyamide precursor material layer to oxygen-containing plasma;

removing exposed portions of the cured polyimide precursor material for exposing portions of the pole tip layer; and

removing the exposed portions of the pole tip layer for forming a pole tip.

2. A method as recited in claim 1, wherein the curing converts at least a substantial portion of the polyimide precursor material to at least one of a polyimide and a polyimide-like material.

3. A method as recited in claim 1, wherein the oxygen etch-resistant layer is a silicon-containing resist.

4. A method as recited in claim 1, wherein the oxygen etch-resistant layer consists of a sputtered film.

5. A method as recited in claim 1, wherein the exposed portions of the cured polyimide precursor material are removed by reactive ion etching.

6. A method as recited in claim 1, wherein the exposed portions of the pole tip layer are removed by milling.

7. A method as recited in claim 1, further comprising adding a first layer of material resistant to chemical mechanical polishing above the pole tip layer.

8. A method as recited in claim 1, further comprising adding a layer of nonmagnetic material for substantially encapsulating the pole tip.

9. A method as recited in claim 8, further comprising adding a second layer of material resistant to chemical mechanical polishing above the layer of nonmagnetic material.

10. A method as recited in claim 1, wherein the remaining portion of the pole tip layer has a width of less than about 100 nm.

11. A pole tip formed according to the method recited in claim 1.

12. A method for forming a pole tip, comprising:

forming a pole tip layer of magnetic material;

adding a first layer of material resistant to chemical mechanical polishing above the pole tip layer;

adding a layer of polyimide precursor material above the first layer of material resistant to chemical mechanical polishing;

baking the polyimide precursor material;

adding an etch resistant layer above the layer of polyimide precursor material;

patterning the etch resistant layer;

removing exposed portions of the polyimide precursor material for exposing portions of the pole tip layer;

removing the exposed portions of the pole tip layer for forming a pole tip;

adding a layer of nonmagnetic material for substantially encapsulating the pole tip;

adding a second layer of material resistant to chemical mechanical polishing above the layer of nonmagnetic material; and

polishing for removing material above the first layer of material resistant to polishing.

13. A method for forming a magnetic structure, comprising:

forming a layer of magnetic material;

adding a first layer of material resistant to chemical mechanical polishing above the pole tip layer;

adding a layer of polyimide precursor material above the first layer of material resistant to chemical mechanical polishing;

baking the polyimide precursor material;

adding an etch resistant layer above the layer of polyimide precursor material;

patterning the etch resistant layer;

removing exposed portions of the polyimide precursor material for exposing portions of the layer of magnetic material;

removing the exposed portions of the layer of magnetic material;

adding a layer of nonmagnetic material for substantially encapsulating the remaining portion of the layer of magnetic material; and

polishing for removing material above the first layer of material resistant to polishing.

14. A method as recited in claim 13, wherein the etch resistant layer is formed of a silicon-containing resist.

15. A method as recited in claim 13, wherein the etch resistant layer is a glass-like material.

16. A method as recited in claim 13, wherein the baking converts at least a substantial portion of the polyimide precursor material to at least one of a polyimide and a polyimide-like material.

17. A method as recited in claim 13, wherein the layer of nonmagnetic material has a thickness at least as great as a thickness of the layer of magnetic material.

18. A method as recited in claim 13, wherein the layer of nonmagnetic material has a thickness greater than a thickness of the layer of magnetic material, wherein the layer of nonmagnetic material forms a plane that is above a top surface of the layer of magnetic material.

19. A method as recited in claim 13, further comprising adding a second layer of material resistant to chemical mechanical polishing above the layer of nonmagnetic material.

20. A method as recited in claim 19, wherein a lower surface of the second layer of material resistant to chemical mechanical polishing lies above a plane positioned above a plane extending along an upper surface of the pole tip.

21. A method as recited in claim 13, wherein the magnetic structure has a width of less than 100 nm.

22. A magnetic storage system, comprising:

magnetic media;

at least one head for reading from and writing to the magnetic media, each head having a pole tip formed according to the method of claim 1;

a slider for supporting the head; and

a control unit coupled to the head for controlling operation of the head.

23. A perpendicular pole tip structure, comprising:

a pole tip layer of magnetic material having a top surface, a bottom surface, and sides extending between the top and bottom surface;

layers of non-magnetic materials surrounding the layer of magnetic material towards the sides of the pole tip layer; and

interface layers above the non-magnetic material, portions of the interface layers lying along a plane substantially parallel to the top surface of the pole tip layer;

wherein portions of the interface layers taper towards the pole tip layer at a slope that is from about one to about five times a thickness of the pole tip layer, where the thickness of the pole tip layer is defined between the top and bottom surfaces thereof.

24. A perpendicular pole tip structure as recited in claim 23, wherein each of the interface layers includes a layer of chemical mechanical polishing resistant material.

25. A perpendicular pole tip structure as recited in claim 23, further comprising a layer of chemical mechanical polishing resistant material above the top surface of the pole tip layer.

26. A magnetic storage system, comprising:

magnetic media;

at least one perpendicular head for reading from and writing to the magnetic media, the head comprising:

a pole tip layer of magnetic material having a top surface, a bottom surface, and sides extending between the top and bottom surface;

layers of non-magnetic materials surrounding the layer of magnetic material towards the sides of the pole tip layer; and

interface layers above the non-magnetic material, portions of the interface layers lying along a plane substantially parallel to the top surface of the pole tip layer, wherein portions of the interface layers taper towards the pole tip layer at a slope that is from about one to about five times a thickness of the pole tip layer, where the thickness of the pole tip layer is defined between the top and bottom surfaces thereof;

a slider for supporting the head; and

a control unit coupled to the head for controlling operation of the head.

27. A magnetic storage system as recited in claim 26, wherein each of the interface layers includes a layer of chemical mechanical polishing resistant material.

28. A magnetic storage system as recited in claim 26, further comprising a layer of chemical mechanical polishing resistant material above the top surface of the pole tip layer.